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(71) 出願人 390001177

クラレケミカル株式会社

岡山県備前市鞆海4342

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(72) 発明者 阿部 進

岡山県備前市鞆海4342 クラレケミカル株

式会社内

(31) 優先権主張番号 特願平(1)-365852

(72) 発明者 石部 静雄

岡山県備前市鞆海4342 クラレケミカル株

式会社内

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(54) 【発明の名称】 活性炭及びその製造方法

(57) 【要約】

【課題】 小分子物質を効果的に吸着することのできる活性炭及びその製造方法を提供する。

【解決手段】 細孔径が細い、比表面積が500~3000 m<sup>2</sup>/g、かつ25℃1気圧下に於ける窒素の吸着量が10 ml/g以上の活性炭により上記課題を解決することができる。このような活性炭は、炭素質材料を、炭酸ガスを主成分とし、水蒸気が2容量%以下で且つ一酸化炭素ガスを2容量%以上を含む雰囲気下600~1200℃の温度で焼活することによって製造される。

## PATENT ABSTRACTS OF JAPAN

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(71)Applicant : KURARAY CHEM CORP

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(72)Inventor : ABE SUSUMU  
ISHIMURA SHIZUO

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(54) ACTIVATED CARBON AND ITS MANUFACTURING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an activated carbon capable of adsorbing small molecular weight materials efficiently and its manufacturing method.

SOLUTION: The pore diameter of the activated carbon is uniform, the specific surface area is 500-3,000 m<sup>2</sup>/g and the adsorption quantity of nitrogen is 10 ml/g or more at 25°C and 1 atmospheric pressure. The activated carbon is manufactured by the activation of a carbon material at 600-1,200°C under an atmosphere that contains carbon dioxide as the main component, 2 vol.% or less steam and 2 vol.% or more carbon monoxide.

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## TECHNICAL FIELD

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[Field of the Invention] This invention relates to the manufacture approach of activated carbon and activated carbon. In more detail, specific surface area is large and it is related with the manufacture approach of the activated carbon which is excellent in adsorption of small molecule gas, such as nitrogen, and the activated carbon which carries out activation of the carbonaceous ingredient with little alkaline metals to the bottom of a specific ambient atmosphere, and manufactures activated carbon. A set and specific surface area have a large pore diameter, and the activated carbon of this invention fits adsorption of small molecule gas, such as hydrogen, nitrogen, oxygen, carbon dioxide gas, a hydrogen chloride, hydrogen fluoride, methane, ethane, an argon, a krypton, a xenon, a methanol, ethanol, formic acid, and a methylene chloride, and since it has the adsorption engine performance which was excellent under pressurization from ordinary pressure, it can be used suitable for the occlusion and adsorption separation of these gas. Moreover, since it excels in adsorption of small molecule matter, such as underwater trihalomethane, it can use also for the application of water treatment.

## EFFECT OF THE INVENTION

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[Effect of the Invention] A set and specific surface area have [ the activated carbon obtained by this invention ] a large pore diameter. Such activated carbon is excellent in adsorption of the small molecule matter, and can be used for the occlusion of natural gas, such as adsorption of rare gas, such as a radioactive krypton generated from adsorption separation, such as nitrogen, hydrogen, a carbon monoxide, carbon dioxide gas, a hydrogen chloride, and hydrogen fluoride, and a boiling water reactor, and a xenon, and methane, a gasoline adsorption canister, a methanol and an ethanol adsorption equation refrigerator, an electric double layer capacitor, a water purifier, etc.

## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] however, most ash content -- a lock out hole and an in-house -- since it is deeply alike and is incorporated in many cases, it is difficult for effectiveness to fully remove bad very much in washing by an acid, water, etc. which were indicated by JP,7-155589,A. Moreover, although pore distribution of the activated carbon indicated by JP,51-28590,A has a sharp peak near 9-10A and a certain amount of small molecule matter can be adsorbed, it is hard to say that it is activated carbon with still sufficient adsorption effectiveness, and there is room of amelioration. Therefore, the purpose of this invention is to offer the activated carbon which can adsorb the small molecule matter efficiently, and its manufacture approach.

## [Brief Description of the Drawings]

[Drawing 1] It is the pore-radius frequency distribution Fig. of the activated carbon obtained in examples 8 and 9 and the examples 8 and 10 of a comparison.

[Drawing 2] It is the accumulation pore volume curve of the activated carbon obtained in examples 8 and 9 and the examples 8 and 10 of a comparison.

[Drawing 3] It is the graph which shows the krypton of the activated carbon obtained in examples 8 and 12 and the example 8 of a comparison, and the adsorption engine performance of a xenon.

[Drawing 4] It is the graph which shows the adsorption engine performance of the

chloroform of the activated carbon obtained in examples 8 and 12 and the example 8 of a comparison.

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of activated carbon and activated carbon. In more detail, specific surface area is large and it is related with the manufacture approach of the activated carbon which is excellent in adsorption of small molecule gas, such as nitrogen, and the activated carbon which carries out activation of the carbonaceous ingredient with little alkaline metals to the bottom of a specific ambient atmosphere, and manufactures activated carbon. A set and specific surface area have a large pole diameter, and the activated carbon of this invention fits adsorption of small molecule gas, such as hydrogen, nitrogen, oxygen, carbon dioxide gas, a hydrogen chloride, hydrogen fluoride, methane, ethane, an argon, a krypton, a xenon, a methanol, ethanol, formic acid, and a methylene chloride, and since it has the adsorption engine performance which was excellent under pressurization from ordinary pressure, it can be used suitable for the occlusion and adsorption separation of these gas. Moreover, since it excels in adsorption of small molecule matter, such as underwater trihalomethane, it can use also for the application of water treatment.

[0002]

[Description of the Prior Art] Activated carbon is widely used from the former in various fields, such as decolorization purification in the adsorption treatment of harmful gas, gas purification and separation recovery, the occlusion of gas, molecular sieving, food, and the chemical-industry field, water treatment, and an electric double layer capacitor. Usually, although activated carbon is manufactured by carrying out activation of the carbonaceous ingredient carbonized beforehand by the oxidizing gas which uses a steam as a principal component, as for the activated carbon obtained, what has pore distribution [ large a pole diameter and comparatively broadcloth ] is common. Such activated carbon can be broadly applied to the various purposes, and is practical.

[0003] In recent years, the application application of activated carbon has spread sharply and to adsorb small molecule matter which used and mentioned activated carbon above as one of the application of the, such as hydrogen and nitrogen, is tried. The small molecule matter has a comparatively small diameter of a molecule, and moreover, there is much what has the low boiling point, and since it is low concentration further, it is possible [ it ] to use activated carbon with a small pole diameter for adsorbing the small molecule matter. However, by the conventional activated carbon which raised whenever [ activation ], a pole diameter cannot become excessive, the fall of adsorption capacity cannot be caused, and the small molecule matter cannot fully be adsorbed. Therefore, the present condition is adsorbing the small molecule matter using the activated carbon which stopped whenever [ activation ] low and made specific surface area small.

[0004] On the other hand, the detailed pole diameter has gathered, and the activated carbon fiber is known as activated carbon with a large specific surface area. However, although there are many rates of micropore, since bulk density is low, since it is very expensive, so many moreover, the amount of adsorption per volume cannot say an

activated carbon fiber as that which is practical as an adsorbent of the small molecule matter to usual activated carbon.

[0005] Until now as the manufacture approach of the activated carbon suitable for adsorption of the small molecule matter to JP,51-28590,A Use carbon dioxide gas as a principal component for vegetable carbide, such as coconut husks, and contamination gas concentration, such as a steam and oxygen, performs activation using 2% or less of activation gas. When activation loss in quantity reaches to 5 - 20%, meltable components including an alkali component are removed by washing by the acid and water, and the approach of carrying out activation again is learned. Moreover, the method of manufacturing the activated carbon which makes ash content less than [ 4wt% ] for the carbonaceous ingredient or activated carbon which has pore by the acid, boiling, or sonication, subsequently carries out activation in a oxidizing gas ambient atmosphere, has uniform detailed pore in JP,7-155589,A, and has high specific surface area in it is indicated.

[0006]

[Problem(s) to be Solved by the Invention] however, most ash content -- a lock out hole and an in-house -- since it is deeply alike and is incorporated in many cases, it is difficult for effectiveness to fully remove bad very much in washing by an acid, water, etc. which were indicated by JP,7-155589,A. Moreover, although pore distribution of the activated carbon indicated by JP,51-28590,A has a sharp peak near 9-10A and a certain amount of small molecule matter can be adsorbed, it is hard to say that it is activated carbon with still sufficient adsorption effectiveness, and there is room of amelioration. Therefore, the purpose of this invention is to offer the activated carbon which can adsorb the small molecule matter efficiently, and its manufacture approach.

[0007]

[Means for Solving the Problem] In order to have adsorbed the small molecule matter effectively, the pole diameter could obtain a set and activated carbon with a large specific surface area by arranging a pole diameter, and carrying out activation of the carbonaceous ingredient under a specific ambient atmosphere, as a result of repeating examination wholeheartedly paying attention to it being important to enlarge specific surface area, and according to this activated carbon, this invention persons resulted that the small molecule matter could be adsorbed efficiently in a header and this invention. That is, this invention is activated carbon characterized by the amount of adsorption of the nitrogen [ a pole diameter can set to a set and / specific surface area ] under 500-3000ml/g and 25-degree-C1 atmospheric pressure being 10 or more ml/g.

[0008] Carbon monoxide gas is the manufacture approach of activated carbon that another invention of this invention uses a carbonaceous ingredient as a principal component, and a steam carries out activation of the carbon dioxide gas at the temperature of 600-1200 degrees C to the bottom of the ambient atmosphere more than 2 capacity % below 2 capacity %.

[0009] When the heating carbonization of another invention of this invention is carried out at 600 degrees C among inert gas, The content of the alkaline metals contained in carbide uses carbon dioxide gas as a principal component, and carbon monoxide gas sets [ a steam ] the carbonaceous ingredient beyond 0.5wt% under the ambient atmosphere more than 2 capacity % below 2 capacity %. When activation is carried out at the temperature of 600-1200 degrees C and loss in quantity of a carbonaceous ingredient

reaches to 5 - 50%, an acid and water wash. After making content of alkaline metals into less than [ 0.5wt% ], carbon dioxide gas is again used as a principal component, and steams are below 2 capacity % and the manufacture approach of the activated carbon in which carbon monoxide gas carries out activation at the temperature of 600-1200 degrees C to the bottom of the ambient atmosphere more than 2 capacity %.

[0010]

[Embodiment of the Invention] As a carbonaceous ingredient used by this invention, the carbide of the pitch which made the raw material the corks of vegetable systems, such as coconut husks, a palm coconut, a kind of fruits, saw dust, a eucalyptus, and a pine, a coal system, and a petroleum system and them, phenol resin, vinyl chloride resin, vinylidene chloride resin, etc. can be raised. In addition, although the configuration of a carbonaceous ingredient and especially size are not limited, the thing of the shape of the 1mm - about 10mm letter of crushing, granularity, or a cylinder is common. Moreover, as a configuration of a carbonaceous ingredient, it can also be carbonized and used, after adding and casting binders, such as powdered or tar, a pitch, and phenol resin, a grain and. The configuration of those molding objects can be made into configurations of arbitration, such as a grain, powder, the shape of a honeycomb, and fibrous.

[0011] As for these carbonaceous ingredients, it is desirable to use that whose content of alkaline metals, such as sodium contained in the carbide when carrying out heating carbonization at 600 degrees C among inert gas, a potassium, and calcium, is less than [ 0.5wt% ]. Inert gas here means gas, such as nitrogen, an argon, and helium. The content of the alkaline metals of a carbonaceous ingredient can carry out 850-degree-C heating ashing in a muffle furnace of the carbonaceous ingredient which carried out heating carbonization at 600 degrees C among the above-mentioned inert gas, and can ask for it with a fluorescent X-ray method.

[0012] In this invention, although activation is carried out and being preferably considered as activated carbon using the above carbonaceous ingredients, in order to consider as activated carbon from a carbonaceous ingredient, in a carbonaceous ingredient with little [ preferably ] above mentioned alkaline metals, a steam sets carbon dioxide gas under the ambient atmosphere more than 2 capacity % by considering as a principal component, and below 2 capacity % and carbon monoxide gas are performed by carrying out activation at the temperature of 600-1200 degrees C. Although not limited especially about activation time amount, since the homogeneity of pore will be spoiled if it carries out not much for a short time when using a carbonaceous ingredient with a particle size of 3mm or more, it is desirable to perform activation for at least 1 hour or more. Usually, it carries out even in about 50 hours.

[0013] According to this invention, by carrying out activation of the carbonaceous ingredient under such a special ambient atmosphere, a set and specific surface area have a large pole diameter, and activated carbon excellent in adsorption of small molecule matter, such as nitrogen, can be manufactured. When the content of the alkaline metals contained in the carbide when carrying out heating carbonization at 600 degrees C among inert gas uses the carbonaceous ingredient beyond 0.5wt% Use carbon dioxide gas as a principal component similarly, and a steam is below 2 capacity %, and activation of the carbon monoxide gas is carried out at the temperature of 600-1200 degrees C into the ambient atmosphere containing more than 2 capacity %. When loss in quantity by the activation of a carbonaceous ingredient reaches to 10 - 30% preferably 5 to 50% An acid

and water wash and content of alkaline metals is made into less than [ 0.5wt% ]. While after desiccation or moisture had been included, it puts into an activation furnace, carbon dioxide gas is again used as a principal component after an appropriate time, a steam is below 2 capacity %, and activation of the carbon monoxide gas is carried out at the temperature of 600-1200 degrees C into the ambient atmosphere containing more than 2 capacity %.

[0014] As an acid, organic acids, such as an acid of inorganic systems, such as a hydrochloric acid, a sulfuric acid, a nitric acid, a phosphoric acid, fluoric acid, and carbonic acid, or formic acid, and an acetic acid, are suitable. Generally it is used in a water solution and usually carries out at 1 - 30wt% as the concentration. Moreover, when a cleaning effect can be further heightened after acid cleaning by removing the salts which remain in a carbonaceous ingredient, and an acid with rinsing or hot-water washing and it shifts to a next activation process at coincidence, it is suitable also in respect of the corrosion of equipment, or waste gas processing. Although not limited especially about the amount of water in that case, it is practical to carry out by 10 - 50 weight twice to a carbonaceous ingredient.

[0015] Although it is desirable to carry out activation as for the carbonaceous ingredient which finished washing after drying, it is also possible to omit desiccation, to supply to an activation furnace immediately, and to carry out activation. In the activation process of this invention, carbon dioxide gas is used as an oxidizing gas, and although it is important to make it the ambient atmosphere which makes a steam below 2 capacity %, including carbon monoxide gas more than 2 capacity %, diluting carbon dioxide gas with inert gas, such as nitrogen and an argon, does not interfere.

[0016] 600-1200 degrees C of activation temperature are 800-1100 degrees C preferably. Moreover, since activation time amount produces activation spots within and without a too short grain child and the homogeneity of pore is spoiled, when the particle size of the carbonaceous ingredient used as a raw material is less than 1mm, after reaching predetermined temperature, it is desirable to carry out activation by 3mm or more 30 minutes or more for 1 hour or more, and it is desirable to carry out activation regardless of how of particle size for 3 to 30 hours. In addition, although it is not necessary to limit the longest activation time amount especially from the field of the engine performance of activated carbon, it is desirable to carry out within [ in 30 hours ] from a industrial field. An activation furnace can use the thing of various formats that what is necessary is just that by which a reaction is carried out to homogeneity. Usually, a fluidized bed furnace, a multihearth furnace, a rotary furnace, etc. are suitable. Any of a batch type and continuous system are sufficient as an activation method.

[0017] The pole diameter has gathered and, as for the activated carbon of this invention, the amount of adsorption of the nitrogen [ specific surface area ] under 500-3000m<sup>2</sup>/g and 25-degree-C1 atmospheric pressure shows 10 or more ml/g. Specific surface area can be measured with a nitrogen gas adsorption BET adsorption method, and the amount of adsorption of nitrogen can be measured with a constant-pressure volumetric method (Chemical Society of Japan 47,716 (Showa 1)). The pore-radius frequency distribution Fig. which measured the activated carbon of this invention with the steam adsorption process is shown in drawing 1 , and an accumulation pore volume curve is shown in drawing 2 . The pole diameter of the activated carbon of this invention has gathered, in the range whose specific surface area is 1000-1200m<sup>2</sup>/g, value  $\frac{V}{V_{logr}}$  (cc/A and g)



of pore-radius frequency distribution is 1.3 or more, and value  $\frac{V}{A} \log r$  (cc/A and g) of pore-radius frequency distribution shows 2.8 or more in the range whose specific surface area is 1400-1600m<sup>2</sup>/g so that clearly from drawing. In addition, in r, a pore radius (A) and  $\frac{V}{A}$  express pore volume variation (cc).

[0018] Although a pole diameter cannot necessarily explain clearly why a set and specific surface area can manufacture the activated carbon suitable for big adsorption of the small molecule matter by this invention A reaction rate is made to fall by making carbon monoxide gas live together more than 2 capacity %, using the carbon dioxide gas which hardly contains a steam as a oxidizing gas, and it is imagined as what is depended on having realized the slow speed activation conditions which can fully be reached by activation gas to a pore deep part. In addition, rapid activation is controlled by lessening alkaline metals, such as sodium in the carbonaceous ingredient used for manufacture of activated carbon, a potassium, and calcium, and it is imagined as what it has also contributed to the manifestation of effectiveness that a uniform activation reaction came to be performed to the pore deep part. Hereafter, an example explains this invention concretely.

[0019]

[Example] What crushed the carbide with which the content of examples 1-7 and the example 1 of a comparison - 7 alkaline metals carbonized the phenol resin not more than 0.5wt% at 600 degrees C in magnitude with a particle size of 1-3mm is used as a carbonaceous ingredient. Using the batch type flow activation furnace with a bore of 50mm, carbon dioxide gas was used as the principal component, and the steam carried out activation of the carbon monoxide gas at 900 degrees C to the bottom of the ambient atmosphere more than 2 capacity % below 2 capacity % (examples 1-7). Moreover, the physical properties of the activated carbon (examples 6-7 of a comparison) with which the activated carbon (examples 1-5 of a comparison) and the steam which carried out activation at 900 degrees C to the bottom of the ambient atmosphere of only a steam, excluding a carbon monoxide at all carried out activation, and were obtained at 900 degrees C under the ambient atmosphere more than 2 capacity % are combined, and are shown in Table 1.

[0020]

[Table 1]

	原 名	料 Na,K,Ca 含有率	賦活ガス組成(残N <sub>2</sub> )			物 性		
			CO <sub>2</sub>	H <sub>2</sub> O	CO	比表面積	窒素吸着量 25℃ 1 atm	炒り吸着量 25℃ 30atm
		(wt%)	(Vol%)	(Vol%)	(Vol%)	(m <sup>2</sup> /g)	(ml/g)	(wt%)
実施例 1	7L/1樹脂	0.01	40	0	4	1100	12.8	
" 2	"	"	"	"	"	1520	13.3	
" 3	"	"	"	"	"	2050	12.0	344
" 4	"	"	"	"	"	3100	10.8	362
" 5	"	"	20	"	"	1500	13.3	326
" 6	"	"	"	1	"	1540	13.0	
" 7	"	"	"	"	2	1520	12.8	
比較例 1	7L/1樹脂	0.01	0	30	0	1130	9.6	
" 2	"	"	"	"	"	1490	9.8	
" 3	"	"	"	"	"	2010	9.4	296
" 4	"	"	"	"	"	2820	8.5	311
" 5	"	"	20	10	"	1490	9.9	285
" 6	"	"	"	"	4	1350	9.8	60
" 7	"	"	"	"	2	1530	9.8	63

[0021] Activation was carried out like the example 1 about examples 8-14, the example 8 of a comparison - 15 coconut husks, and palm charcoal (examples 8-14). Moreover, about the coconut shell charcoal whose content of alkaline metals is about 0.8 wt(s)%, after cooling, when activation loss in quantity reached to 20wt(s)%, it took out from the furnace, and washing by the hydrochloric acid and water was performed, less than [ 0.5wt% ] was made to reduce alkaline metals, and activation was again performed on the same conditions (example 15). The physical properties of the obtained activated carbon are shown in Table 2. In addition, the example 12 of a comparison is activated carbon manufactured according to the approach indicated by JP,51-28590,A.

[0022]

[Table 2]

原 料	原 称	賦活後 洗浄 (有無)	Na,K,Ca 含有率 (wt%)	賦活ガス組成(体積N2)				物 質			性 質
				CO <sub>2</sub>	H <sub>2</sub> O	CO	比表面積	窒素吸着量 25℃ 1atm	窒素吸着量 25℃ 30atm	メタン吸着量 30℃ 3.7Vol %	
実施例 8	やし焼炭	有	0.14	40	0	4	1010	10.8	298	69	(wt%)
	" 9	"	0.16	"	"	"	1520	11.4	314		
	" 10	"	0.21	"	"	"	2050	11.0	334		
	" 11	"	0.12	"	"	6	3010	10.2	341		
	" 12	"	0.25	20	"	4	1500	11.4	304		
	" 13	"	0.45	"	"	"	1540	10.6	284		
比較例 8	バスム炭	"	0.15	40	0	"	1520	10.0	301	52	(wt%)
	やし焼炭	無	0.88	0	30	0	1130	8.3	242		
	" 9	"	0.56	"	"	"	1490	8.1	266		
	" 10	"	0.98	40	0	4	1510	8.9	276		
	" 11	"	1.22	"	"	"	2720	8.6	278		
	" 12	有	0.15	20	0	0	980	9.8	261		
比較例 15	バスム炭	有	0.16	0	20	4	1590	8.6	255	7.1	(wt%)
	" 13	"	0.12	20	10	0	1460	8.3	245		
	" 14	"	0.64	0	30	4	1530	7.1	245		

[0023] As 16 to examples 15-18 and example of comparison 19 coconut shell charcoal, and a coal raw material, the carbide which carbonized the YARUN charcoal from Australia and the Datong charcoal from China at 600 degrees C was used as the carbonaceous ingredient, activation was carried out on the same conditions as an example 1, and activated carbon was obtained. The physical properties of activated carbon and the measurement result of n-butane working capacity which were obtained are shown in

Table 3. In addition, n-butane working capacity is the measuring method set to ASTM-D 5228-92, and if it states briefly, the practical concentration which deducted the weight after desorption from the weight after adsorption per 100ml of activated carbon will be said. A result is shown in Table 3.

[0024]

[Table 3]

	原 料			試活ガス組成(残りN2)			物 性		
	名 称	試活後 洗浄	Na,K,Ca 含有率	CO2	H2O	CO	比表面積	窒素吸着量 25℃ 1atm	n-ブタン・キシレン 吸着量 ASTM-D5228-92
		(有無)	(wt%)	(Vol%)	(Vol%)	(Vol%)	(m2/g)	(ml/g)	(g/100ml)
実施例 1 5	活性炭	有	0.07	40	0	4	1170	10.0	9.8
" 1 6	"	"	0.12	"	"	"	1430	10.2	11.5
" 1 7	大同炭	"	0.15	"	"	"	1120	10.3	10.7
" 1 8	"	"	0.18	"	"	"	1480	10.1	12.6
比較例 1 6	活性炭	無	0.58	"	"	"	1130	7.2	7.6
" 1 7	"	"	0.66	"	"	"	1410	6.7	8.8
" 1 8	大同炭	"	0.67	"	"	"	1160	7.3	8.3
" 1 9	"	"	0.72	"	"	"	1420	6.1	9.8

[0025] The adsorption engine performance of a krypton and a xenon was measured about the activated carbon obtained in the example 8, the example 8 of a comparison, and the example 12 of a comparison. A result is shown in drawing 3 . Moreover, the adsorption engine performance of the chloroform which is the representation of trihalomethane was measured, and it was shown in drawing 4 . In addition, the amount of adsorption of chloroform was based on the following measuring method.

[0026] After pulverizing an activated carbon sample until a 45-micron passing material becomes 90% or more with a sample mill, it dries at 115 degrees C for 3 hours, and cools radiationally in a desiccator. The vial bottle which added 100ml of chloroform water solutions beforehand adjusted to concentration 100ppb is prepared separately, a fines sample is weighed precisely, and it is \*\*\*\*\* to a vial bottle. A vial bottle is sealed with a Teflon sheet, an isobutylene-isoprene-rubber cup, and an aluminum seal, and is shaken with a shaker at 25 degrees C for 2 hours. Moreover, the vial bottle which does not add a sample as a blank also performs same actuation in parallel.

[0027] The vial bottle after 2-hour progress is taken out, and after adding and shaking methanol 10microl by the micro syringe, it puts in a 25-degree C constant temperature bath for 1 hour. 0.1ml of head gas of a 1 hour after vial bottle is extracted by the micro syringe, and chloroform concentration is measured using an ECD gas chromatograph. A blank is measured similarly. The chloroform concentration, the residual concentration, and the amount of activated carbon samples of an undiluted solution to the chloroform amount of adsorption is computed from a degree type. amount-of-adsorption (mg/g activated carbon) = (A-B)/(Cx10000) -- in addition, A is [ residual chloroform concentration (ppb) and C of undiluted solution chloroform concentration (ppb) and B ] the amounts of samples (g). The result of having measured the adsorption engine performance of a methanol is collectively shown in Table 1 and 2 about an example 3, an

example 4, the example 3 of a comparison, the example 4 of a comparison, an example 10, and the example 10 of a comparison. The effectiveness of this invention is clear from Table 1 and 2.

[0028]

[Effect of the Invention] A set and specific surface area have [ the activated carbon obtained by this invention ] a large pole diameter. Such activated carbon is excellent in adsorption of the small molecule matter, and can be used for the occlusion of natural gas, such as adsorption of rare gas, such as a radioactive krypton generated from adsorption separation, such as nitrogen, hydrogen, a carbon monoxide, carbon dioxide gas, a hydrogen chloride, and hydrogen fluoride, and a boiling water reactor, and a xenon, and methane, a gasoline adsorption canister, a methanol and an ethanol adsorption equation refrigerator, an electric double layer capacitor, a water purifier, etc.

## CLAIMS

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[Claim(s)]

[Claim 1] Activated carbon characterized by the amount of adsorption of the nitrogen [ a pole diameter can set to a set and / specific surface area ] under 500-3000m<sup>2</sup>/g and 25-degree-C1 atmospheric pressure being 10 or more ml/g.

[Claim 2] The manufacture approach of activated carbon that use carbon dioxide gas as a principal component, and carbon monoxide gas carries out [ a steam ] activation of the carbonaceous ingredient at the temperature of 600-1200 degrees C to the bottom of the ambient atmosphere more than 2 capacity % below 2 capacity %.

[Claim 3] The manufacture approach of activated carbon according to claim 2 that the content of the alkaline metals contained in carbide is less than [ 0.5wt% ] when this carbonaceous ingredient carries out heating carbonization at 600 degrees C among inert gas.

[Claim 4] When heating carbonization is carried out at 600 degrees C among inert gas, the content of the alkaline metals contained in carbide the carbonaceous ingredient beyond 0.5wt% Use carbon dioxide gas as a principal component, and carbon monoxide gas sets [ a steam ] it under the ambient atmosphere more than 2 capacity % below 2 capacity %. When activation is carried out at the temperature of 600-1200 degrees C and loss in quantity of a carbonaceous ingredient reaches to 5 - 50%, an acid and water wash. The manufacture approach of the activated carbon in which uses carbon dioxide gas as a principal component again, and carbon monoxide gas carries out [ a steam ] activation at the temperature of 600-1200 degrees C to the bottom of the ambient atmosphere more than 2 capacity % below 2 capacity % after making content of alkaline metals into less than [ 0.5wt% ].